**Introduction and Motivation**

We are developing new hybrid polymer systems based on methacrylates. Tailoring prepolymer properties like viscosity enables them for different shaping and molding processes:

- **Inkjet**
- **Offset**
- **Flexographic printing**
- **Nano-imprint-lithography (NIL)**
- **Reaction molding**

**In addition** we are able to adjust the **refractive index** which is important to reduce coupling losses due to reflections between two optical components (e.g. waveguides and LEDs). We are also able to achieve the necessary **difference in refractive indices** between core and cladding of potential waveguides.

**Polymerization** is performed under UV-light which gives the opportunity to use even processes like inkjet printing where high temperatures during the shaping processes occur.

**Materials**

**Polymer matrix**

- **Main polymer**: Syntholux®, an epoxy acrylate, diluted with 80% tripropylene glycol diacrylate (TPGDA)

- **Comonomer**:
  1) ethylene glycol dimethacrylate (EGDMA)
  2) Benzyl methacrylate (BMA)
     - Crosslinking agent for higher stability
     - Diluting monomer for lower viscosity

- **Dopant**: phenanthrene (electron rich)

**Initiators**

- **UV**: Diphenyl(2,4,6-trimethylbenzoyl)phosphine oxide
- **Thermal**: Dilauroyl peroxide

**Experimental**

**Sample preparation**

- **Casting mould**
- **FEP foils**
- **Glass plates**

**Curing**

- **UV-LEDs**
- 405 nm
- 8 min @ 25%

**Refractive index**

- 3 samples each
- Wavelengths: 450, 589, 680 nm
- Temperature: 20°C

**Results I – Viscosity adjustment**

<table>
<thead>
<tr>
<th>Syntholux + benzyl methacrylate</th>
</tr>
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<tbody>
<tr>
<td>0 40 80 120 160 200 240 280 320</td>
</tr>
<tr>
<td>0 20 40 60 80 100 120 140 160 180</td>
</tr>
<tr>
<td><strong>Syntholux + 5% phenanthrene</strong></td>
</tr>
<tr>
<td><strong>Syntholux + 10% phenanthrene</strong></td>
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</tbody>
</table>

**Results II – Optical adjustment / properties**

<table>
<thead>
<tr>
<th>Syntholux + benzyl methacrylate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 40 80 120 160 200 240 280 320</td>
</tr>
<tr>
<td>0 20 40 60 80 100 120 140 160 180</td>
</tr>
<tr>
<td><strong>Syntholux + BMA / EGDMA</strong></td>
</tr>
<tr>
<td><strong>Syntholux + BMA / EGDMA</strong></td>
</tr>
</tbody>
</table>

**Summary**

- **Wide range of viscosity adjustment**: 4 mPa·s < η < 48 Pa·s
- **Refractive index tunable**: 1.51 < n < 1.58
- **Optical damping as low as** 0.05 db/mm
- **Glass transition temperature up to** 62 °C

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**Tailoring Optical and Rheological Properties of an epoxy acrylate based Host-Guest System**

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